canopy in the clouds
dosel en las nubes

CLOUD CATCHING

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Grade Level: 6-8

Introduction: Not surprisingly, scientists who study the cloud forest are interested in the clouds that are constantly covering the landscape. Yet how can one capture a cloud to learn more about it? Biologist Greg Goldsmith created a "cloud collector" in an attempt to do just that. Students will examine Goldsmith's cloud collector to better understand his design and will contemplate the challenges inherent in "catching" a cloud. Students will then follow the design process to design their own cloud catchers. Students will also work with peers to discuss strengths and limitations of their designs.

Major Themes: Abilities of technological design

Connections to National Science Education Standards: Design a solution or product (E); evaluate completed technological designs or products (E); communicate the process of technological design (E); understandings about scientific inquiry (A); understandings about science and technology (E); science and technology in society (F); science as a human endeavor (G).

Time: 100 minutes (5 minutes for Opening, 5 minutes for handout introduction, 20 minutes for "Monteverde's Clouds" (handout), 30 minutes for "Designing a Cloud Catcher" (handout), 15 minutes for "Peer Conferencing" (handout), 10 minutes for group work, 15 minutes for closing)

Materials: Students will need to view the following videos:
Panorama 3: Canopy video 1
Panorama 4: Ground video 3
Additional Media: "Harp Collector" video

Students will also use images from the "Behind the Scenes –Wet Season" album on the "Photographs" page found within "Additional media".

Computers with internet access (at least one; preferably enough for one per pair of students)
LCD projector
Plain paper and/or graph paper (at least two pieces per student)
Colored pencils (optional)
Cloud Catching student handout

Objectives: Students will be able to: (1) design a product to address a problem, (2) anticipate and explain limitations of products.

Potential Misconceptions:
(1) Students may think that science and technology are essentially the same thing. While firmly connected, science and technology are two different realms. Science can drive technological innovation and technology can aid humans in their scientific endeavors. It is helpful to think of science as the way(s) in which we try to understand our world and technology as the tools we implement in this pursuit. Students at this level may not fully understand this distinction, but they should recognize that there *is* a distinction.

(2) "Best" can have any number of meanings when it comes to product design. The "best" product for a given task is often the one that is not unsurpassed in any single category (e.g., cost, efficacy, hazardousness), but rather the one that performs well overall across several categories.

PROCEDURE

Opening: Write the following terms on the board (in any order) so that they are present when students enter the room: insect, baseball, sunlight, precipitation, airplane, cloud, sandstorm, wind. First ask students if they can think of anything these terms have in common. Consider all suggestions before revealing this answer: They all spend some time in the atmosphere. Next ask students to group the terms into "things that can be caught/captured" and "things that cannot be caught/captured". Allow time for students to write down their ideas then invite students to share their ideas. Be sure to ask students to explain their reasoning. After some debate, it is okay to agree to disagree and move on, as this is not a question that has a definitive answer.

Circle the word "cloud" on the board, and tell students that today they will be focusing on how to catch clouds for scientific research.

Development: Distribute the *Cloud Catching* student handout. Read the introduction and "Basic Cloud Information" aloud together. Next, use the computer and LCD projector to guide students to the appropriate *Canopy in the Clouds* resources. If students are working alone or in pairs at computers, you can then allow them to complete the "Monteverde's Clouds" portion of the handout on their own. Otherwise, work through this section together.

Once students have completed this work, read through the "Designing a Cloud Catcher" section together. Encourage students to ask clarifying questions. When you are content that students understand the task, allow them to begin working on this section of the

handout on their own. Circulate around the room, check in with students as they are working, and ask questions that help them elaborate on their design ideas. For example: *How will you connect those pieces? What material would work well there? Can this be transported up into the canopy?*

When students are ready for peer conferences, assign partners and ask students to begin the "Peer Conferencing" section of the handout. If students have to relocate to work with their partners, they should be sure to bring their *Cloud Catching* handout and cloud catcher design with them.

After peer conferencing, pair up partner groups so that four students are working together. Allow time for students to share their work with one another. Ask the groups to choose one design to present to the class. When presenting the design to the class, students should be prepared to explain how the device works and why the group selected it.

Closing: Ask students which of the designs they have seen today (1) could reasonably be constructed and (2) might work in Monteverde to collect accurate cloud data. Encourage students to share their thoughts on the design process as a whole, and on the challenges in selecting one design among many. Emphasize that the design process they experienced today is what many scientists do on a regular basis as they try to find new ways to collect data about their research questions.

Suggested Student Assessment: Assign "Cloud Catching: Student Assessment" handout for homework. Collect and grade student work. After assessment has been returned to students, go over the answers to any frequently missed questions.

Extending the Lesson: 1) Students may wish to share their cloud catcher designs with the Canopy in the Clouds research team! Any interested student should write a short letter introducing him/herself and explaining the design. The letters and final drafts of the designs can be scanned and sent electronically to the *Canopy In The Clouds* team, or you may assemble student work and mail hard copies to the *Canopy In The Clouds* office. (2) Students can build selected designs and then test them out by spraying them with a spray bottle of water.

Vocabulary: evaporation, water vapor, condensation, dissipate, components, feasible, biosphere, atmosphere, lithosphere, hydrosphere, limitations, implement

WORKSHEETS: *Cloud Catching* student handout, *Cloud Catching: Student Assessment* handout